

Y., 26th, 4:25 p. m., very violent wind storm, trees uprooted and fences and buildings demolished. Savoy, Tex., 28th, during the evening this town was almost entirely destroyed by a violent tornado, 15 persons killed and 60 wounded. At Suffield, Conn., on the 29th, about 1:30 p. m., a violent tornado, accompanied with torrents of rain and very heavy hail, passed from SW. to NE. through the township, crossing the Connecticut river directly opposite Thompsonville, where it lifted large bodies of water and demolished boats. In Thompsonville and also through the remaining portion of Enfield township to the eastward the destruction to property was very severe. From 20 to 30 buildings, several fine orchards and groves of choice forest trees were demolished. Width of storm track, about one mile, the boundary lines of destruction on either side being sharply defined, objects in close proximity escaping the slightest injury. In less than 10 minutes from the time the dark clouds were first seen in the west the entire destruction throughout Suffield was completed. The whirling action of the storm cloud was clearly evidenced by the peculiar twisting of the trees from right to left and the spreading of the debris in circles. The loss was estimated at from \$30,000 to \$40,000.

Sand-storms.—Umatilla, Oregon, 7th; Winnemucca, 2nd, 3rd, 4th, 22nd, 23rd; Burkes, Arizona, 12th, 13th, 22nd, 23rd, 24th, 25th; Colorado Springs, Colorado, 14th; North Platte, 11th, 12th, 13th, 14th; Yankton, 4th; Fort Garland, Col., 6th, 17th, 21st; Fort Union, N. M., 6th, 7th, 9th, 12th, 13th, 14th, 25th.

Waterspouts.—April 23rd, Schooner A. K. Bently in latitude 31°, 59', N. longitude 79°, 20', W., reported a remarkable waterspout in the SE., distant about one mile from vessel. It appeared to be an immense volume of water pouring from a dense black cloud. Yates Center, Kan., May 9th, waterspout burst on Vermillion river, 6 miles west of station, raising the water 16 feet in 20 minutes; thousands of fish were killed, not only where the spout burst, but for several miles below. Punta Rassa, Fla., 10th, between 5:50 and 6:05 p. m. a waterspout was seen near Sanibel Island, about two miles from observer, resembling the tall trunk of a coconut palm; it was of uniform diameter and brilliant whiteness. Altitude 20° and slightly inclined from the perpendicular at the top towards the east. The base for an apparent distance of 30 or 40 feet, was surrounded by a violently agitated mass of water. The body was a hollow cylinder composed of spray and water ascending with a rapid spiral motion from right to left; it moved from NE. to SW. and vanished from the bottom upwards. On Mustang creek, 4½ miles east of Colorado or Concho river, Texas, on the 28th, a huge waterspout, accompanied by an indescribable hissing, roaring noise, passed down the creek, drowning the horses of a party camped near by, and carrying away all their camp equipage and wagons; thousands of fish were thrown upon the banks.

VERIFICATIONS.

Indications.—The detailed comparison of the tri-daily indications for May, with the telegraphic reports for the succeeding twenty-four hours, shows the general percentage of verifications to be 82.8 per cent. The percentages for the four elements are: Weather, 88.3; Direction of the Wind, 81.6; Temperature, 79.0; Barometer, 81.7 per cent. By geographical districts they are: for New England, 77.4; Middle States, 82.6; South Atlantic States, 90.4; Eastern Gulf States, 87.7; Western Gulf States, 86.2; Lower Lake region, 80.6; Upper Lake region, 81.5; Tennessee and the Ohio valley, 83.0; Upper Mississippi valley, 80.7; Lower Missouri valley, 77.3; Northern Pacific region, 84.2; Central Pacific coast region, 85.5; Southern Pacific coast region, 87.5. There were 17 omissions to predict out of 3,813, or 0.45 per cent. Of the 3,796 predictions that have been made, 127, or 3.35 per cent, are considered to have entirely failed; 219, or 5.77 per cent, were one-fourth verified; 430, or 11.33 per cent, were one-half verified; 585, or 15.41 per cent, were three-fourths verified; 2,435, or 64.14 per cent, were fully verified, so far as can be ascertained from the tri-daily weather maps.

Cautionary Signals.—188 Cautionary Signals were displayed during the month, of which 142, or 75 per cent., were justified by winds of 25 miles per hour or over at, or within a radius of 100 miles of the station. 33 Off-shore Signals were displayed, of which 27, or 81.8 per cent, were fully justified; 28, or 84.8 per cent, were justified as to velocity and 32, or 97.0 per cent as to direction. 6 of the Off-shore were changed from Cautionary. 221 Signals of both kinds were displayed, of which 169 or 76.5 per cent, were fully justified. The above does not include signals ordered for 50 display stations, where the velocity is only estimated. 114 cases of winds of 25 miles and over per hour, from scattered stations, were reported, and for which signals had not been ordered.

NAVIGATION.

In the table on the right-hand side of chart No. III are given the highest and lowest readings of the Signal Service river gauges for the month of May, 1880, with the dates of the same. As a general rule the rivers fell throughout the month. The *Red River*, at Shreveport, and the *Arkansas*, at Little Rock, fell steadily throughout the month. The *Missouri* and *upper Mississippi* changed but little throughout the month. The *Mississippi*, at Cairo, rose three feet from the 1st to the 6th, fell slowly to the 28th, and rose two feet to end of month; at Memphis it rose from the 1st to the 11th, after which it fell to end of month; at Vicksburg the water fell slowly from the 1st to the 5th, and remained almost stationary thence to 15th, on the 15th a more decided fall, which continued to end of month, set in and the water passed below the danger-line on gauge, after having been above that point for a period of 9 weeks; at New Orleans the water fell slowly throughout the month, passing the danger-line on the 26th, after having been above that point

for a period of 11 weeks. The *Ohio*, *Cumberland* and *Tennessee* fell generally throughout the month at all stations.

Ice in Rivers and Harbors.—During the present month Duluth is the only station, within the limits of the Signal Service, reporting interruption of navigation by ice, and the following notes from this station are interesting: On the 1st, steamer *Quebec* made her way through eight miles of ice, which blocked the harbor, and was the first arrival of the season; on the 3rd, steamer *J. L. Hurd* started out, but became blocked in the ice about two miles from shore, and was unable to proceed until the 4th; on the 6th, several vessels were blocked in the ice while coming into port; on the 13th, vessels were still blocked, and the ice in some places was estimated to be forty feet deep, being backed up by strong NE. winds; on the 15th, some vessels succeeded in passing out, and on the 19th, the ice was driven out by strong westerly winds and the lake reported clear.

High Tides.—At Indianola on the 1st, 15th and 16th; on the latter date the water covered the streets, in some places to a depth of 18 inches. At Galveston, 15th, 16th, and 17th; on the 16th many streets were partly under water. At Pensacola, 24th, very high tide.

TEMPERATURE OF WATER.

The temperature of water as observed in rivers and harbors, with average depth at which observations were taken, is given in the table on the left-hand side of chart No. II. At the following stations observations were not made on the dates indicated: Duluth, 1st to 9th, hindered by ice; San Francisco, 1st to 17th, instrument broken.

ATMOSPHERIC ELECTRICITY.

Thunder-storms—were reported from the various districts on the following dates: New England, 3rd to 7th, 9th, 10th, 19th to 21st, 26th to 28th; Middle Atlantic States, 5th, 9th, 10th, 11th, 14th, 20th to 23rd, 26th, 27th, 28th; South Atlantic States, 4th, 11th, 12th, 22d, 23rd, 24th, 28th and 30th; Eastern Gulf States, 2d, 4th, 10th, 11th, 12th, 13th, 20th, 23rd, 24th to 27th, 29th, 30th, 31st; Western Gulf States, 1st, 2d, 4th, 5th, 12th to 16th, 18th, 19th, 20th, 23rd to 31st; Lower Lake region, 8th, 9th, 10th, 19th to 22d, 26th, 27th, 29th to 31st; Upper Lake region, 5th, 7th, 9th, 10th, 18th, 19th, 23rd, 24th, 31st; Ohio valley and Tennessee, 5th, 9th, 10th, 11th, 12th, 20th, 23rd, 24th, 27th, 29th, 31st; Upper Mississippi valley from 3rd to 31st; Lower Missouri valley, 3rd, 6th, 8th to 19th, 21st, 23rd to 31st; Eastern Rocky Mountain slope, 8th, 9th, 14th, 18th, 19th, 20th, 26th, 28th, 31st; Colorado, 19th and 28th; New Mexico, 28th; Utah, 26th; Wyoming, 3rd; Idaho, 15th; California, 12th at Princeton and Red Bluff; Washington Ter., 7th and 27th.

Auroras.—During May, 1880, three general auroral displays were observed over the United States, namely: on the 1st and 2nd, extending from Eastport, Me. to Montana; on the 14th, extending from New Hampshire and Massachusetts to Lake Superior, and from the 26th to the 28th, from New Hampshire to Montana. The most southerly stations reporting auroras were: Girard, Kans., New Corydon, Ind., and New London on the 1st; Woodstock, Md., on the 4th (very faint) and Cedar Vale, Kans., on the 7th. La Crosse, Wis., 1st, from 8:45 p. m. to midnight; color nearly white; in form of an arch, with lower edge well defined, with centre 10° above horizon. Below arch a dense haze, very dark in color and in striking contrast with the rest of the sky, which was very bright and clear. No beams or columns, merely a diffuse light, quite brilliant at times, nearly disappearing for a few seconds, and reappearing again. Arch extended from about 40° east to 30° west of magnetic meridian. Bismarck, 1st, 9:00 p. m., observed in northwest, extending upward about 30° . Duluth, 1st, 9 p. m., light grayish color, two arches, breaking up about 10 p. m. into beams of light, shooting upward to a great height, some of larger beams reaching to several degrees beyond the zenith. Aurora also observed at 10 p. m. of 2nd. Toledo, 1st, 10:50 p. m., shifting from E. to W. along the north horizon, many streamers reaching to zenith, disappeared at 11:30 p. m. Eastport, 1st, 8:20 p. m. to 2:45 a. m. of 2nd. Burlington, Vt., 2nd, 11:15 p. m. to 12:30 a. m., 3rd, green, dark segment, no arch of light or streamers. New London, 1st, 9 to 11 p. m. Bangor, Me., 2nd, 11:35 p. m. to midnight, very brilliant beams and daucers; altitude 45° ; azimuth 75° to 290° . Clear Creek, Neb., 1st, 8 p. m. to 11 p. m., from W. to NE. brightest in NW. Cresco, Ia., 1st, 9:15 p. m., bright low arch in NE. 10 p. m., a few straggling streamers; 10:30 p. m., disappeared; 2nd, 10:30 p. m., a few faint streamers starting from northern horizon. Gardiner, Me., 1st, 9 p. m. to midnight, very bright. 2nd, not very bright; obscured by clouds before midnight. Newburyport, Mass., 2nd, diffuse light above dark segment; a few streamers, no motion, disappeared at 10:20 p. m. Lima, N. Y., 1st, 9:50 to 10:50 p. m., faint, E. three to five streamers. St. Paul, 1st, 10 p. m., dark segment, with luminous arc; continuous motion from to W.; color, pale yellow and orange; remained visible about 40 minutes; telegraph wires perceptibly affected. Pembina, 1st, appeared at 8:30 p. m., and continued throughout night; no continuous arch except for a minute or two, and dark segment scarcely visible. The aurora extended from about 160° to 280° azimuth, with an altitude at various times reaching to the zenith; colors, crimson, yellow and green, very transparent. Breckenridge, 1st, 8 to 10:40 p. m., light green color tinged with red. Burlington, Vt., 14th, from 9 p. m. to 12:30 a. m. of the 15th, light arch of light, pale green. Auburn, N. H., from 9:20 p. m., of 14th, to early morn of 15th. Toledo, 26th, 8:50 p. m., altitude of streamers, 30° to 90° ; no lateral motion; disappeared at 11 p. m. Oswego, 26th, 9:15 to 9:50 p. m., NE. to NW.; altitude to zenith; dark segment sur-